

EXERCISES

For more practice, see *Extra Practice*.

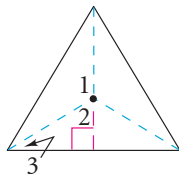
Practice and Problem Solving

A Practice by Example

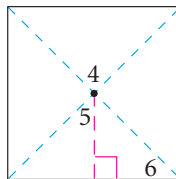
Example 1 (page 380)

Each regular polygon has radii and apothem as shown. Find the measure of each numbered angle.

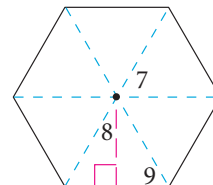
1.



2.



3.



Example 2 (page 381)

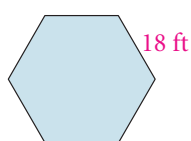
Find the area of each regular polygon with the given apothem a and side length s .

4. pentagon, $a = 24.3$ cm, $s = 35.3$ cm
5. 7-gon, $a = 29.1$ ft, $s = 28$ ft
6. octagon, $a = 60.4$ in., $s = 50$ in.
7. nonagon, $a = 27.5$ in., $s = 20$ in.
8. decagon, $a = 19$ m, $s = 12.3$ m
9. dodecagon, $a = 26.1$ cm, $s = 14$ cm

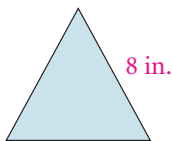
Example 3 (page 381)

Find the area of each regular polygon. Round your answer to the nearest tenth.

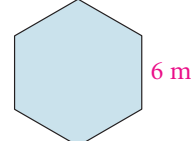
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11.



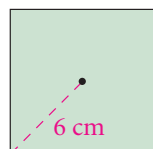
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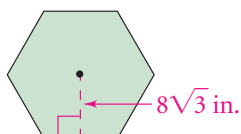
Example 4 (page 382)

Find the area of each regular polygon with the given radius or apothem. If your answer is not an integer, leave it in simplest radical form.

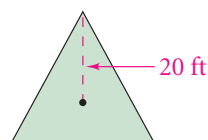
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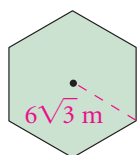
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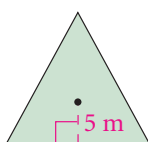
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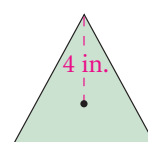
16.



17.



18.



B Apply Your Skills

Find the measures of the angles formed by (a) two consecutive radii and (b) a radius and a side of the given regular polygon.

19. pentagon
20. octagon
21. nonagon
22. dodecagon



23. Architecture The gazebo in the photo is built in the shape of a regular octagon. Each side is 8 ft long, and its apothem is 9.7 ft. To the nearest tenth, find the area enclosed by the gazebo.

24. The area of a regular polygon is 36 in.^2 . Find the length of a side if the polygon has the given number of sides. Round your answer to the nearest tenth.

- a. 3
- b. 4
- c. 6

d. Estimation Suppose the polygon is a pentagon. What would you expect the length of its side to be? Explain.

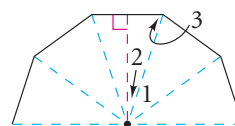


Need Help?

In Exercise 25, $m\angle 1$ is what part of 360?



25. A portion of a regular decagon has radii and an apothem drawn. Find the measure of each numbered angle.



26. **Writing** Explain why the radius of a regular polygon is greater than the apothem.

27. **Satellites** One of the smallest space satellites ever developed has the shape of a pyramid. Each of the four faces of the pyramid is an equilateral triangle with sides about 13 cm long. What is the area of one equilateral triangular face of the satellite? Round your answer to the nearest whole number.

Find the area of each equilateral triangle with the given radius. Round your answers to the nearest whole number.

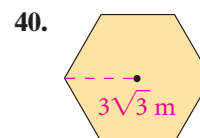
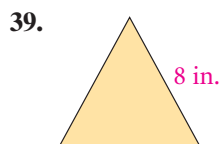
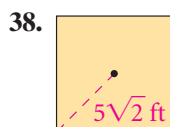
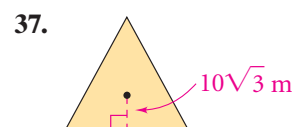
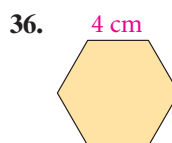
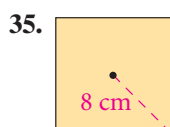
28. $r = 10$ in. 29. $r = 4.6$ m 30. $r = 8.9$ ft 31. $r = 13$ cm

32. **Constructions** Use a compass to construct a circle.
 a. Construct four perpendicular radii of the circle.
 b. Construct radii that bisect each of the four right angles.
 c. Connect the consecutive points where the radii intersect the circle. What regular polygon have you constructed?
 d. **Critical Thinking** How can a circle help you construct a regular hexagon?

33. A regular hexagon has perimeter 120 m. Find its area.

34. **Open-Ended** Create a design using equilateral triangles and regular hexagons that have sides of the same length. Find the area of the completed design.

Find the area of each regular polygon. Show your answers in simplest radical form and rounded to the nearest tenth.



41. To find the area of an equilateral triangle, you can use the formula $A = \frac{1}{2}bh$ or $A = \frac{1}{2}ap$. A third way to find the area of an equilateral triangle is to use the formula $A = \frac{1}{4}s^2\sqrt{3}$. Verify the formula $A = \frac{1}{4}s^2\sqrt{3}$ in two ways as follows:

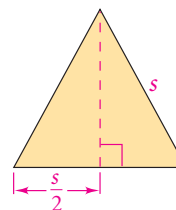


Figure 1

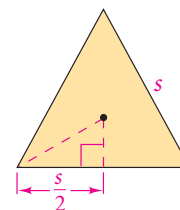


Figure 2

- a. Find the area of Figure 1 using the formula $A = \frac{1}{2}bh$.
 b. Find the area of Figure 2 using the formula $A = \frac{1}{2}ap$.

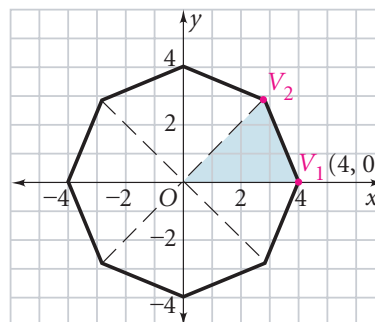


42. For Example 1 on page 380, write a proof that the apothem bisects the vertex angle of the isosceles triangle formed by the radii.

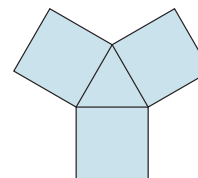
**Challenge Proof**

43. Prove that the bisectors of the angles of a regular polygon (given congruent sides and angles) are concurrent and that they are, in fact, radii of the polygon. (Hint: For regular n -gon $ABCDE \dots$, let P be the intersection of the bisectors of $\angle ABC$ and $\angle BCD$. Show that \overline{DP} must be the bisector of $\angle CDE$.)

44. **Coordinate Geometry** A regular octagon with center at the origin and radius 4 is graphed in the coordinate plane.



- Since V_2 lies on the line $y = x$, its x - and y -coordinates are equal. Use the Distance Formula to find the coordinates of V_2 to the nearest tenth.
 - Use the coordinates of V_2 and the formula $A = \frac{1}{2}bh$ to find the area of $\triangle V_1OV_2$ to the nearest tenth.
 - Use your answer to part (b) to find the area of the octagon to the nearest whole number.
45. a. Find the area of the triangle if the area of each square is 10 cm^2 .
 b. When a square and an equilateral triangle share a common side, what is the ratio of the area of the triangle to the area of the square? Leave your answer in simplest radical form.

**Standardized Test Prep****Multiple Choice**

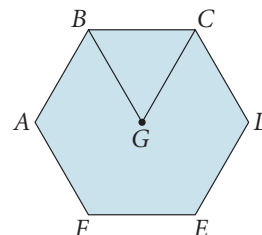
46. What is the area of a regular pentagon whose apothem is 25.1 mm and perimeter is 182 mm?
 A. 913.6 mm^2 B. 2284.1 mm^2 C. 3654.6 mm^2 D. 4568.2 mm^2
47. The area of a regular octagonal garden is 1235.2 yd^2 . The apothem is 19.3 yd. What is the perimeter of the garden?
 F. 128 yd G. 154.4 yd H. 186.6 yd I. 192 yd
48. The radius of a regular hexagonal sandbox is 5 ft. What is the area to the nearest square foot?
 A. 30 ft^2 B. 65 ft^2 C. 75 ft^2 D. 130 ft^2

Short Response

49. The perimeter of a regular decagon is 220 in. Its radius is 35.6 in.
 a. Explain how to use the given information to find its area.
 b. Find the area.

Extended Response

50. In regular hexagon $ABCDEF$, $BC = 8\sqrt{3}$ ft.
 a. Find the area of $\triangle BCG$.
 b. Find the area of hexagon $ABCDEF$.
 c. Describe two different methods for finding the area of hexagon $ABCDEF$.

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Mixed Review

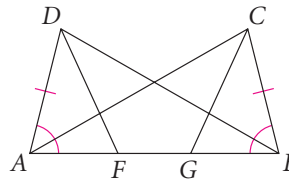
Lesson 7-4

51. Find the area of a kite with diagonals 8 m and 11.5 m.
52. The area of a kite is 150 in.^2 . The length of one diagonal is 10 in. Find the length of the other diagonal.
53. The area of a trapezoid is 42 m^2 . The trapezoid has a height of 7 m and one base of 4 m. Find the length of the other base.

Lesson 4-4

Name the pairs of triangles you would have to prove congruent so that the indicated congruences are true by CPCTC.

Given: $\angle DAB \cong \angle CBA$,
 $\overline{AD} \cong \overline{BC}$,
 \overline{DF} bisects $\angle ADB$,
 \overline{CG} bisects $\angle BCA$.



54. $\overline{AC} \cong \overline{BD}$
55. $\overline{AG} \cong \overline{BF}$
56. $\angle DFA \cong \angle CGB$

Lesson 1-7



57. a. **Biology** The size of a jaguar's territory depends on how much food is available. Where there is a lot of food, such as in a forest, jaguars have circular territories about 3 mi in diameter. Use 3.14 for π to estimate the area of such a region to the nearest tenth.
- b. Where food is less available, a jaguar may need up to 200 mi^2 . Estimate the radius of this circular territory.